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CHARACTERISTICS OF STUDENTS IN THE HEALTH RELATED PROFESSIONS.

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THIS MONOGRAPH PRESENTS A PORTION OF A LONGITUDINAL STUDY BEING CONDUCTED BY THE REHABILITATION RESEARCH INSTITUTE AT THE UNIVERSITY OF FLORIDA. THE TOTAL PROGRAM ATTEMPTS TO IDENTIFY THE CHARACTERISTICS OF STUDENTS IN EACH OF THE HEALTH RELATED PROFESSIONS. THE CHARACTERISTICS SOUGHT ARE THOSE WHICH DISCRIMINATE ONE PROFESSION FROM ANOTHER AND THOSE WHICH LEAD TO PROFESSIONAL SUCCESS. FRESHMAN AND SOPHOMORE FEMALE STUDENTS WHO EXPRESSED A CAREER CHOICE OF OCCUPATIONAL THERAPY, PHYSICAL THERAPY, MEDICAL TECHNOLOGY, OR OTHER HEALTH PROFESSIONS COMPRISED THE SAMPLE. DATA ON THESE STUDENTS WERE COLLECTED USING A NUMBER OF INSTRUMENTS INCLUDING THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY (MMPI) AND STRONG VOCATIONAL INTEREST BLANK, FEMALE FORM (SVIB). DETAILED ANALYSES OF THE TESTS, INCLUDING FACTOR ANALYSIS OF THE MMPI AND SVIB, WERE CONDUCTED. DISCRIMINANT ANALYSIS USING A D-SQUARE TEST OF THE FIVE MEASURES WAS USED IN AN ATTEMPT TO DISTINGUISH STUDENTS SELECTING EACH OF THE FOUR PROFESSIONAL FIELDS. THE RESEARCHERS FOUND THE SVIB TO DISCRIMINATE MOST EFFECTIVELY. FUTURE PLANS INCLUDE CONTINUING RESEARCH WITH STUDENTS FOUND TO BE SUCCESSFUL IN THE ACADEMIC AND CLINICAL ASPECTS OF THE HEALTH PROFESSIONS. PREDICTIVE EQUATIONS OF ACADEMIC SUCCESS AND JOB SUCCESS ARE EXPECTED TO AID COUNSELING OF STUDENTS INTERESTED IN THE HEALTH RELATED PROFESSIONS. (NS)

# CHARACTERISTICS OF STUDENTS IN THE HEALTH RELATED PROFESSIONS

by

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# CHARACTERISTICS OF STUDENTS IN THE HEALTH RELATED PROFESSIONS

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# PREFACE

The findings to be described in this monograph are from one of two research programs being carried on by the Regional Rehabilitation Research Institute. This research is being conducted in the College of Health Related Professions at the University of Florida. The Research Institute, a unit of that College, is supported by a grant from the Vocational Rehabilitation Administration of the United States Department of Health, Education, and Welfare.

The College of Health Related Professions, along with the Colleges of Medicine, Nursing, and Pharmacy, comprise the J. Hillis Miller Health Center at the University of Florida. There are nine other Colleges and two schools in the University. The Health Center is designed to provide educational and research facilities for inter-professional relationships in several of the health professions.

The College of Health Related Professions was established in 1958 and offers bachelor's degrees in: Occupational Therapy, Physical Therapy, and Medical Technology, and a Master's degree in Rehabilitation Counseling. All specialized courses, intern and practicum courses related to the Doctorate in clinical psychology are provided by staff in the Department of Clinical Psychology. The Department of Communicative Disorders relates to the training of physicians and other health personnel as well as to support the training of speech pathologists and audiologists in the College of Arts and Sciences. A Master's degree in Health and Hospital Administration is jointly administered by the College of Business Administration and the College of Health Related Professions.

The Regional Rehabilitation Research Institute was established in 1962 after several years of preliminary discussions between regional, state and national rehabilitation personnel and the staff of the College of Health Related Professions. There are now eight of these Research Institutes, each relating to a different region of the country and each with specific research interests. The Research Institutes provide consultation in rehabilitation research problems and carry on research in rehabilitation. At this time the two main research programs of this Institute at the University of Florida concern (1) client motivation for rehabilitation, and (2) characteristics of students in the health related professions. This latter research program is described in this monograph.

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# INTRODUCTION

This monograph has two general purposes. First, research findings about motivation and other personality characteristics of students in several of the health related professions will be described and discussed. Second, the research program, of which this investigation is a part, will be presented in detail.

The research program on student personnel characteristics has two related areas of inquiry; first, an examination of the motivation and other personality characteristics which might discriminate among students entering several of the health related professions; and second, an examination of the personality and other characteristics which might differentiate students who do well from those who do poorly in these same health related professions.

This longitudinal research program has been under way at the University of Florida's College of Health Related Professions during the past four years. The program was conceived in its general outlines by John R. Barry with the help of the faculties of the College of Health Related Professions. Most of the specific studies summarized in this monograph were conducted by Harry E. Anderson, Jr., who was responsible for the day-to-day operation of this research program in 1963-64*, and by George H. Dunteman, who has the primary responsibility for the research program now.

In this research monograph, then, pertinent research will be summarized relating to the general areas of career choice in the health related professions, the identification of differences among students in some of the different professions, and the prediction of successful performance in these professions. The research projects to be discussed are parts of an on-going longitudinal research program whose phases are described below in the design section. Several preliminary studies have been completed and will be described herein. Other studies are in progress or in the planning stages, and these will be referred to where appropriate. In all, the monograph is meant to describe in detail this research program of the Research Institute on student characteristics in the health related professions.

* now at the University of Georgia.

The first section of the monograph includes a discussion of some of the research literature which was considered in the development of the research program. This is followed by a description of methodological considerations. The design of the research program is described in subsequent sections and then specific analyses of some of the predictor measures are presented and discussed.

It will be noted that most of the specific studies described concern differences among students who have stated in their sophomore year that they will enter one or another of the health related professions. Thus the criterion was stated interest during the second year of college. Analogous discrimination studies are underway, using as a criterion the actual vocational training choice which the student has made. In these later studies, the criterion will be determined by the specific field in which the student actually was trained rather than by what the student stated he wanted to study. Only one study has been done so far concerning the prediction of success in training and this is described. Overall the monograph is meant to describe an on-going research program from which some studies have emerged, while other studies are in various stages of completion.

A problem frequently encountered in higher education is that of advising a student into one of a number of major fields. Frequently, students enter a college with no idea of any specific major. In the College of Health Related Professions (CHRP) there currently are three undergraduate curricula in which a student might enroll. These are Occupational Therapy (OT), Physical Therapy (PT), and Medical Technology (MT). Students enrolled in these three curricula are being compared and contrasted with groups of students not enrolled in these specialty programs. These latter students all have expressed some interest in the specialty programs by enrolling in a sophomore level course oriented toward the health related professions.

The purpose of the present research program is to yield information about differences (1) among different groups of students in health related professions, and (2) among groups of students who achieve and those who do not. Such information will be useful in selection, in counseling, and for vocational guidance. With such information, more efficient utilization of the pool of applicants for training will be obtained.

## Curricula Group Differences

Although a great deal of research has been conducted on differences among students in different curricula, little research has concerned those specific groups upon which the present research program is focused: OT, PT, MT, Nursing and Education. A preliminary review

of the literature concerning differences and similarities among students in the various health related professions has yielded little relevant research.

Implicit in the examination of differences among students in different curricula is the question of the attraction of various curricula for different kinds or types of people. Another important consideration is the probability that although students in various curricula differ, the fields themselves may enhance and modify these differences, at least in some instances. There is probably a complex interaction between the kinds or types of people who elect to take training in a given specialty and its subsequent effect on them.

Bereiter and Freedman (1961) made an excellent review of student differences among several fields of study. They found that some fields are relatively more attractive to liberal-minded people, whereas other fields are more attractive to conservative-minded people. They found another major attitudinal dimension independent of liberalism vs. conservatism that could be labeled inner- versus other- directedness. These authors then developed a two by two classification system employing these two attitudes as the orthogonal axes. They found that different student groups fell into different quadrants. For example, the arts and sciences students fell into the quadrant defined as liberal and inner-directed, while students in education, business and public service could be described as conservative and other-directed. The authors also reviewed student group differences in mental abilities and personality.

Lehman (1965) found that females majoring in medical technology had the highest scores on a number of cognitive measures but were the most dogmatic of the six female curricula groups which he studied. He also found this group to be the most inner-directed or traditional-value-oriented, suggesting a personality syndrome characterized by authoritarianism, non-receptivity to new ideas, and inflexibility. Lehman suggested that easy-going and adaptive females tended to major in the arts and sciences or in communication arts, while rigid and authoritarian females tended to prefer home economics and medical technology. Dogmatic females tended to favor the technical or vocationally-oriented curricula whereas the more flexible, adaptive females favored the non-technical curricula. Lehman suggested that the more traditionally-value-oriented females preferred the more technically-oriented curricula. These students endorsed absolutism, a positive outlook towards the future, the importance of getting along with others, and conformity. All these differences were found in Lehman's study after the influence of academic ability was partialed out. Lehman concluded that there were marked curricular differences in cognitive, personality and attitude factors among the groups which he studied.

Schmidt (1951) examined student Nurses (N) and Occupational Therapists (OT) to determine common and differential personality and ability patterns among the groups. He obtained MMPI scores, Rorschach scores, and Wechsler-Bellevue Scale of Adult Intelligence scores from 24 Ns in their last year of a three year nurse-training course and from 22 OTs in their fifth and final year of college. Significant differences in the MMPI scores of the two groups were found on the Hypochondriasis (Hs), Psychopathic Deviate (Pd), Psychasthenia (Pt), Manic-Depressive (Ma), and Schizophrenic (Sc) scales. However, when the K-correction was applied to these scales, the Sc scale did not significantly differentiate the two groups. On the remaining five scales no significant differences were found. In general, Schmidt found that the Ns were somewhat less variable and critical of themselves than were the OTs, and scored significantly higher on the Hs, Pd, Pt, Ma scales whether K-corrected or not.

It should be noted that these data were not handled in the most efficient way in that the interrelationships between the individual scales were *not* taken into consideration in the data analysis. Examining each scale on an individual basis without looking at the total pattern of interrelationships, especially when the intercorrelations between the scales are substantial as in the case of the MMPI, will often lead to a different interpretation of the same data. There is some evidence that the probability of rejecting the null hypothesis (Type I error) is increased by separate analyses of intercorrelated variables (see Vanderplas, 1960). This situation is frequently encountered in the published literature. The important point here is that when looking at group differences the variables should be analyzed together rather than separately. There are statistical techniques available for the analysis of group differences on a number of intercorrelated variables. Discriminant analysis is one such technique that handles the data in such a manner and is the technique utilized in some of the investigations with which this paper is concerned.

It should also be noted that studies such as these reviewed above, while pointing out that certain differences exist, do not specify these differences in a manner that indicates the degree of separation between the groups. The degree of separation among groups can only be determined when all the information in the test profile is considered simultaneously in the same analysis. Discriminant analysis both indicates whether or not significant differences exist among groups and more importantly what the distances are among the groups. The practical significance of these distances can then be inferred by the number of individuals correctly classified as a result of likelihood functions derived from the discriminant analysis. A brief discussion of discriminant analysis can be found in the Appendix of this monograph.

In Schmidt's study, the overall Rorschach profiles tended to differentiate the two groups. Schmidt felt that the Ns have to work under greater supervision and have to follow directions more than OTs. He concluded that the Rorschach differences between the two groups were congruent with certain role differences: namely that nurses usually were more closely supervised and more subject to detailed direction than occupational therapists. He concluded that the nurses were more or less nonaggressive, introverted, and rigid while the OTs were more purposeful, extroverted, and adaptive. As far as intellectual capacity was concerned, the OTs scored significantly higher than the Ns on both the Verbal and Performance subtests of the Wechsler-Bellevue.

Although the results of this study suggest certain personality and aptitude differences between OTs and Ns, it should be noted that some of these differences might be explained by differences in socio-economic backgrounds of the two groups. Biographical information tended to indicate that the OTs came from a higher socio-economic background than the Ns.

## Predicting Physical and Occupational Therapy Success

A second purpose of the present research program is to identify the variables related to both academic and job success in each of the health related professions. Gobetz (1954) developed selection test batteries for PTs composed of cognitive, personality, and interest variables to predict academic achievement, performance in supervised clinical practice, and on-the-job performance ratings. A three-year research program based upon tests administered to 702 female and 426 male beginning students in physical therapy yielded two cross validated test batteries which were significantly related to academic and job success. One battery, composed primarily of cognitive elements, yielded a multiple validity coefficient of .48 for female students and .38 for male students for predicting grade point average. The same battery yielded multiple validity coefficients of .56 for females and .46 for males with Registry Examination scores as the criterion. The Registry Examination is a standardized achievement test given nationwide to graduates of PT programs.

Gobetz' other battery comprising a personality inventory and a biographical information blank resulted in a validity coefficient of .35 for females and .28 for males in predicting clinical performance ratings. The results of this study are typical in that academic achievement can be fairly well predicted on the basis of cognitive measures while performance criteria are usually much less adequately predicted from any measures, cognitive or non-cognitive. It is interesting to note that females are more predictable than males in each instance. It is fairly well estab-

lished that females are more predictable than males in academic settings (Abelson, 1952; Seashore, 1961).

Crane (1962) developed a crude screening device for OT majors. Twelve tests were used to measure a number of achievement, aptitude, interest, and personality variables. The criteria were grade-point average upon graduation or upon leaving the program, and overall ratings by staff members. The two criteria were highly intercorrelated probably in part because of rater contamination. A number of measures were found to be significantly related to both criteria, but Crane did not refine a specific test battery for selection purposes. Among the most significant predictors of grade-point average were the Order, Change, Autonomy, and Succorance scales from the Edwards Personal Preference Schedule and Poetry, Reading, and Paragraph Comprehension subtests of the Iowa Silent Reading Test. The Paragraph Comprehension and Rate of Reading subtests of the Iowa Silent Reading Test were among the most significant predictors of the instructor's ratings.

Fishman and Pasanella (1960) summarized some research in predicting college intellective criteria (e.g., grade point average) using intellective, non-intellective, and a combination of both types of predictors. They reported an average correlation of .47 between some commonly used aptitude tests (e.g., American Council on Education Psychological Examination for College Freshment (ACE)), and a comprehensive intellective criterion. The common intellective predictor combination of an aptitude test plus high school grades resulted in a median correlation of .64 in 24 analyses.

As expected, non-intellective predictors did not fare so well in predicting intellective criteria. The median correlation of some of the common personality measures (e.g., MMPI) with intellective criteria for 26 studies was only .22. Interest inventories such as the Strong Vocational Interest Blank yielded even lower correlations ranging from .05 to.26 for seven studies. When intellective and non-intellective predictors were combined, the gain in the multiple correlation due to the non-intellective predictor was quite small. For example, adding the MMPI to intellective predictors resulted in a cross-validated gain of +.06 in the multiple correlation coefficient when predicting intellective criteria.

There is evidence to indicate that personality and interest variables might be better used to moderate the relationship between the intellective predictors and the intellective criteria, rather than being combined in a linear fashion with the intellective predictors. For example, both Stagner (1933) and Hoyt and Norman (1954) found support for the common notion that well-adjusted students were more predictable than maladjusted students. Moreover, Malnig (1964) found that test anxiety served as a moderator which could be used to enhance the pre-

dictability of grades from aptitude test scores. It should be noted, however, that there have been discrepant findings in this area. Sometimes personality variables have functioned as moderators, and at other times, they have not. The moderating effect then is probably a function of the test used and the manner in which the moderator was defined by the test. Some specific findings concerning the moderating effect of the MMPI upon the relationship between intellective predictors and criteria will be discussed below.

# GENERAL METHODOLOGICAL CONSIDERATIONS

## Differential Prediction

Differential prediction is one of the major goals of the research program described in this monograph. That is, we want to determine whether different weights should be applied to the intellective and non-intellective variables when predicting academic or job success across the different academic curricula.

Horst (1956) points out that predicting overall college success is worthwhile, but that differential prediction of success for different college curricula should be much more useful to both students and administrators in selecting majors where the student has the greatest predicted chance of success. It is anticipated that the Research Institute will be able to develop separate regression equations for predicting academic and clinical success from the same set of predictor variables for the OT, PT, and MT curricula. Then, a predicted grade point average and a predicted clinical performance rating in each of the three curricula could be determined for each prospective student. From the discriminant analyses of the same predictor variables, equations predicting the similarity of a prospective student to each of the three groups could be obtained. The regression and discriminant analyses together will indicate for each student his similarity to and predicted success in each of the three curricula.

Tatsuoka (1957) has proposed a model combining the information derived from both regression and discriminant analysis. His model combines the probability of a student being in a certain field of study, with the probability of his graduating in that field, in order to obtain a single overall index indicating which field of study a prospective student should consider. Rao (1962) would recommend first determining whether or not a person belongs to any of the groups currently being considered in the study. Using Rao's approach one should determine whether a student's test profile corresponded to any one of the groups under consideration. If from this analysis a student was found to belong to one of the curricula groups, then he could be advised into the group

to which he was most similar. If one had sample statistics based upon successful students in each of a number of fields, then determining the similarity of a student's multi-score vector to each one of the groups and assigning him to that group which he most resembles, would be somewhat equivalent to using a combined index of (1) the probability of success in a major field and (2) the degree of similarity to the students in the given major field.

An important consideration here is that a prospective student might not be similar to any of the groups of students for which data were available. The student might be more similar to other groups of students for which data were not available. The typical approach in classification studies using discriminant analysis is to assign the student to to that group to which he is most similar. If a student's multi-score vector does not fall near the centroid of any of the p dimensional group regions, then he could be considered to be a member of a different student population and be advised not to enter any of the groups under consideration.

## Criterion Problems

One of the most important aspects of any selection or classification investigation is the criterion which is used as the basis of selection or classification. In academic settings the most commonly used criterion is academic success. However, academic success is only a part of the goal of any academic program. Of at least equal importance is the student's success in his job-related performance after leaving college.

In many instances, the intercorrelations between academic success and success in the clinical and laboratory aspects of the college curricula, or between academic success in college and job success after graduation are very low. For example, Taylor (1964) found, in an abbreviated factor analysis of nursing school grades, two major factors: an academic performance factor, and a clinical performance factor. The author pointed out that at least two separate abilities—academic and clinical—were necessary for the successful completion of nursing school.

Taylor et al. (1965) found that the typical predictors of academic achievement (e.g. ACE) predicted only a small segment of achievement in nursing education. These predictors also did very poorly in predicting achievement in clinical nursing practice course performance. Taylor pointed to the need for non-academic predictors and felt that nursing schools must broaden the basis upon which they select students. The same interpretations could no doubt apply to selection procedures in other health professions. If the results of Taylor's research can be generalized to other settings, then the interrelationship and inter-action

between classroom learning and clinical learning should be closely examined.

The relationship between academic and clinical performance in college to on-the-job behavior after graduation also should be investigated. Taylor. et al. demonstrated the complexity of academic criteria and clinical performance criteria. Richards, Taylor, Price, and Jacobsen (1965) examined the criterion problem for a group of medical specialists and found their performance to be a function of a large number of underlying factors.

The University of Florida Regional Rehabilitation Research Institute has conducted some preliminary criterion studies concerning the roles of OTs and PTs. Jantzen and Anderson (1965) obtained patients' ratings of the OT as a teacher, the OT as a therapist and the general overall impression of the OT as a professional person. The patients also evaluated their own occupational therapy programs. The responses were obtained from a group of patients with physical disabilities (N=140) and a group of psychiatric patients (N=159).

The study was designed to find which of three roles concerning interpersonal relationships were most highly related to the patient's evaluation of his occupational therapy program. For both the psychiatric and physical disability group, all three roles of the therapist were significantly related to the patients' evaluation of occupational therapy. However, in both cases the role of therapist was the most important predictor of the patient's evaluation. The remaining roles did not add much to the prediction of the patient's evaluation. An important implication is that the most important role of the OT as perceived by the patient is not instructional activities such as teaching arts and crafts but the OT's therapy role.

A study somewhat analogous to the OT study was carried out for PTs by Anderson, Aldredge, White, and Wroe (1965). Again, all three roles of the physical therapist were significantly related to the patients' evaluation of the PT program, the therapist role being the most important. As in the OT study, the remaining two roles did not add much to the prediction of evaluation.

These two studies mark the beginning of criterion development for OTs and PTs at the Research Institute. The studies demonstrated the importance of taking into account the patients' perception of the therapist in the development of a criterion. The success of OT and PT can in part be inferred from examining the patients' response to the therapist.

There are heavy clinical aspects involved in the successful performance of the roles of occupational therapist, physical therapist, and to a lesser extent and with a somewhat different emphasis, the role of the medical technologist. The intellective aspects of the criteria can best be pre-

dicted by cognitive measures while the clinical aspects can best be predicted by non-cognitive measures such as personality and attitudes. Taylor et al. (1965) have suggested that there are a number of dimensions underlying intellective or achievement criteria, some of which are not being measured by current aptitude test batteries. A readily available criterion of success in the health related professions might be composed of a weighted combination of academic and clinical measures. The most important weights might be determined by a subjective weighting system or they might be determined statistically by a canonical correlation analysis (Hotelling, 1936).

# DESIGN OF THE PRESENT RESEARCH

## Overview

The present research is concerned primarily with the differences in certain personality, interest, aptitude, achievement, and attitude variables among predominantly freshman and sophomore female students who expressed interest in majoring in a number of different health related professions at the University of Florida. The specific studies to be reported then reflect differences among students classified according to their expressed interests. Only one preliminary study of academic success will be reported here, although others are underway. The studies reported in this monograph comprise the first phase of a longitudinal research program. The second phase, now in progress, involves the utilization of actual admission into a curriculum as the basis of classification on which equations to predict group membership are to be developed. In this same phase, regression equations are to be developed to predict criteria of academic achievement and clinical performance at the end of the students' last year of college.

The last phase of this research program involves follow-up studies of graduates from these academic programs. For example, comprehensive job performance criteria for OTs and PTs are being developed. An attempt will be made to determine if these post-graduate performance criteria can be predicted from the psychological test and other predictor data collected while the students were in their freshman and sophomore years of college. Finally, all of the findings based upon data from the University of Florida, should be cross-validated in other parts of the country and in other kinds of colleges and universities. In addition to the practical implications for counseling and guidance, the findings from this research are expected to yield information regarding the motivations and other personality dynamics and characteristics of young women in these different health related professions.

Data on five psychological tests were collected from the students and analyzed separately by discriminant analysis to see whether the groups defined by stated major field of interest could be differentiated on the basis of the test data. Two instruments, the Strong Vocational Interest Blank and the Minnesota Multiphasic Personality Inventory were factor analyzed prior to the discriminant analysis so that the number of variables used in the discriminant analysis would be reduced. The sample,

criterion groups, psychological test data, and the specific analyses are described below in detail.

## Sample

The subjects in the present studies were predominantly freshman and sophomore white female students enrolled in an introductory course, Introduction to the Health Professions. This course is designed to give students an introduction to most of the health professions, and particularly to occupational therapy, physical therapy, and medical technology. The subjects for these studies were all of the students who were enrolled in this introductory course during the years 1961, 1962, and 1963, at the University of Florida. It should be noted that none of these students had yet been accepted into OT, MT, or PT programs at the time of data collection; however, they were preparing for entrance into one of these fields. Students are accepted into these programs at the end of their sophomore year. Data have also been collected for a substantial number of students in nursing and education. These two groups are to serve primarily as comparison groups in some of the future analyses.

## Criterion Groups

The students in this introductory course were asked on a questionnaire to state a preference for OT, MT, or PT training at the beginning of the course. The students were then classified into four groups on the basis of their stated preference, three groups being OT, MT, and PT and the fourth group being Others (O) who did not express a preference for any of these three fields. These four groups are the criterion groups that were examined for differences on the psychological test data described below.

## Psychological Test Data

The following psychological test data were obtained[1] for each student: (1) The Florida Placement Examination (FPE) which is an achievement test given to all Florida high school seniors. The FPE has four achievement scores in English (Eng), Natural Science (NS), Social

[1]Part of the data for this study was collected under NIMH Project Grant 380, the Public Mental Health Methods in a University. The authors appreciate the loan of these data from Dr. Benjamin Barger, Director of the NIMH Project.

Science (SS), and Mathematics (Math), and a fifth score entitled Psychology (Psy) which is really a quasi-IQ. (2) The School and College Ability Test (SCAT-, Educational Testing Service, 1955), an aptitude test from which verbal (V) and quantitative (Q) scores were obtained (3) The Attitude Toward Disabled Persons (ATDP) test (Yuker et al., 1960), which yielded one score designed to indicate the degree one accepts disabled people. (4) The Minnesota Multiphasic Personality Inventory (MMPI-, Dahlstrom and Welsh, 1960) from which the following clinical scales were obtained: Hypochondriasis (Hs), Depression (D), Hysteria (Hy), Psychopathic Deviate (Pd), Masculinity-Feminity (M-F), Paranoia (Pa), Psychasthenia (Pt), Schizophrenia (Sc), Manic-Depressive (Ma), and Introversion (Si). The Hs, Pd, Pt, Sc, and Ma scales were K-corrected. (5) The Strong Vocational Interest Blank (SVIB), Female Form (Strong, 1959), from which 29 scales were utilized. The listing of these 29 scales can be found in Table 3 (Page 21). Biographical inventory data and some other measures were also obtained from some of the students. The biographical inventory contains items concerning the student's high school activities, family background, and various items pertaining to career choice.

## Statistical Analysis

Discriminant and factor analyses were the two major statistical approaches used in this series of studies. Discriminant analysis involves weighting the predictor variables in such a manner that the groups become maximally separated. A brief description of discriminant analysis is given in the Appendix. Factor analysis is a statistical procedure whereby a number of intercorrelated variables are reduced to a more basic and independent set of factors. In most cases, the number of derived factors are considerably less than the original number of variables, making for easier interpretation of an original set of variables.

## SPECIFIC STUDIES

In this section, eight studies conducted by the Regional Rehabilitation Research Institute are described in detail. One study involved the factor analysis of the ten basic scales of the MMPI and another study involved the factor analysis of 29 scales of the SVIB. Five of the studies were concerned with differentiating MTs, OTs, PT, and Os from each other. A separate study was done employing each of the five psyschological tests. Of these five studies, the ATDP study involved a simple analysis of variance. The remaining four tests were multi-score tests, which were analyzed by discriminant analysis. The final study in this section is concerned with predicting the clinical performance of OT students.

Since one or more sets of test data were missing for several of the students, data from each of the five psychological tests were analyzed separately to see if it would discriminate among the groups. Since the MMPI and SVIB are composed of a number of scales, it was felt that factor analyses of these two instruments might yield a relatively small number of factors to account for the majority of variance in the individual scales. Use of estimated factor scores rather than individual scale scores should simplify the discriminant analysis in that fewer variables would be involved and thus interpretations would be facilitated.

In addition, the factor analyses were expected to yield some interesting information about the characteristics of these two instruments when used with students in the health related professions. For example, the factor analyses might provide insights into the underlying personality and interest structure of female students in the health related professions.

In both factor analyses, the standardized scores of the variables were intercorrelated and the resulting correlation matrix was factored by the principal components method with squared multiple correlations in the principal diagonal. The factor matrix was then machine rotated by the normal varimax rotational procedure (Kaiser, 1958).

## Factor Analysis of the Minnesota Multiphasic Personality Inventory (MMPI)

Several factor analyses of the MMPI have been reported in the literature. However, many of these studies involved psychiatric samples or all male samples. Also, many of the earlier factor analyses have involved a larger number of scales than was considered in the present study. For example, a study by Edwards and Diers (1962) involved 58 MMPI scales. In the present research, primary interest was focused upon the responses of normal females to the basic 10 MMPI scales.

In many studies using various types of samples and differing numbers of scales, two factors have commonly appeared (Welsh and Dahlstrom, 1956). These have been typically labeled as a psychotic factor and a neurotic factor. Tyler (1951), using 107 normal female graduate students and 15 MMPI scales including nine of the basic scales used in the present study, isolated five factors. The first two factors were much like the two major factors found in most other studies. One was labeled general maladjustment and the other general neuroses.

The subjects involved in the MMPI analysis of the present research at the University of Florida were 168 female freshmen and sophomores who later planned to enter OT, PT, or MT. Two factor analyses were conducted, one involving the same correlations corrected for random correlations between scales by either subtracting or adding random correlations from the obtained ones (Anderson, Davis and Wolking, 1966). The second analysis was designed to partial out the influence of item overlap in determining the intercorrelations among the ten scales, since primary interest was focused upon the interrelationships among personality variables, rather than interrelationships due to scoring artifacts.

The first factor analysis yielded four factors while the second analysis yielded six factors. The first three factors from both analyses corresponded very closely. The fourth factor of the first analysis and the last three factors of the second analysis appeared to be residual factors, and could not be interpreted further. A cursory examination of the two factor structures indicated that the random correlations between the scales did not have much influence on the basic factor structure. This was verified systematically by computing canonical correlations between estimates of the two sets of rotated factor scores. The factor scores were computed for each of the rotated factor structures by post-multiplying the standardized score matrix by the matrix of factor loadings. The canonical correlational analysis yielded three extremely high correlations between the two factor structures. The correlations all approached 1.0.

TABLE I

Intercorrelations, Means, and Standard Deviations (SD) of the MMPI Scales* (N=168)

| Scales | Scales | | | | | | | | | | Mean | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hs | D | Hy | Pd | M-F | Pa | Pt | Sc | Ma | Si | | |
| Hs | 72 | 55 | 82 | 47 | 33 | 46 | 62 | 59 | 25 | 34 | 50.32 | 9.73 |
| D | | 68 | 46 | 37 | 13 | 59 | 70 | 54 | 03 | 71 | 50.27 | 10.60 |
| Hy | | | 73 | 56 | 33 | 53 | 58 | 59 | 28 | 26 | 55.04 | 9.65 |
| Pd | | | | 49 | 24 | 45 | 53 | 62 | 43 | 21 | 55.05 | 11.20 |
| M-F | | | | | 19 | 13 | 24 | 35 | 28 | 08 | 48.07 | 10.15 |
| Pa | | | | | | 51 | 62 | 59 | 22 | 50 | 52.98 | 9.71 |
| Pt | | | | | | | 74 | 76 | 34 | 63 | 54.27 | 9.63 |
| Sc | | | | | | | | 70 | 45 | 46 | 53.81 | 9.25 |
| Ma | | | | | | | | | 34 | 02 | 55.17 | 11.82 |
| Si | | | | | | | | | | 59 | 50.52 | 11.30 |

* Decimals omitted from correlations. Squared multiple correlations in the principal diagonal.

Since the two factor analyses agreed so closely, the following discussion is based primarily upon the first analysis. The ten MMPI scales were as follows: Hypochondriasis (Hs), Depression (D), Hysteria (Hy), Psychopathic Deviate (Pd), Masculinity-Feminity (M-F), Paranoia (Pa), Psychasthenia (Pt), Schizophrenia (Sc), Manic-Depressive (Ma), and Introversion (Si). The intercorrelations, means, and standard deviations for the ten MMPI scales are listed in Table 1. The means and standard deviations based upon T scores are very similar to the standardization norms for the MMPI, thus suggesting that the present data are not atypical.

The rotated factor structure is presented in Table 2. The rotated factors are interpreted with reference to MMPI research on normal female college students (Drake and Oetting, 1959; Black, 1953). Each factor will be looked upon as an average profile with the pattern of the factor loadings representing the profile pattern. Interpretations of these factors have also been discussed in detail in Anderson, Davis and Wolking (1966).

The first rotated factor is defined by Si, D, Pt, and Pa. Sc also loads moderatetly high on this factor but has a somewhat higher loading on Factor II. Young women with high scores on these scales or profiles are likely to be seen by others as shy, sensitive, sentimental, prone to worry, serious, natural, and with home and family interests. Under stress or in a college counseling situation these women are likely to be insecure, self-conscious, and indecisive. They feel a lack of skill with the opposite sex and are especially distractable in their studies and tense on examinations.

TABLE 2

Rotated Factor Matrix for MMPI Scales* (N=168)

| Scales | Factors | | | | Communalities |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Hs | 36 | 26 | 76 | 09 | 78 |
| D | 81 | 04 | 31 | —02 | 75 |
| Hy | 27 | 34 | 78 | —07 | 79 |
| Pd | 26 | 58 | 34 | —16 | 54 |
| M-F | 04 | 34 | 26 | 21 | 23 |
| Pa | 58 | 28 | 29 | —22 | 55 |
| Pt | 71 | 43 | 31 | 02 | 79 |
| Sc | 52 | 63 | 31 | 01 | 76 |
| Ma | 01 | 63 | 11 | 02 | 41 |
| Si | 81 | 02 | 07 | 06 | 66 |

* All decimals omitted.

Factor II is primarily defined by Ma and Sc with Pd and Pt also loading substantially on this factor. High scores on these scales are typical of young women who are considered thoughtful, idealistic, and perservering, but also boastful and unemotional. Such young women tend to see themselves as polished, relaxed and thoughtful, yet also as secretive, eccentric, gloomy, and somewhat inarticulate. This factor seems to be defined by the characteristic extroversion, social assertiveness, independence of thought and action, and a tendency toward unsettled personal identification and philosophy. Like the women characterized by Factor I, these women also under stress will become confused, restless, verbal, and resistant in counseling and authority relationships.

Factor III seems to be a doublet defined almost exclusively by Hy and Hs. This type of profile is relatively common among many normal and clinical groups. Black's research (1953) with normal college women suggests that women characterized by this profile have a general impunitive attitude in the way they view others, the world, and themselves. In sharp contrast, other college women have described these individuals as selfish, self-centered, and having many physical complaints. Such women were also seen as neurotic, dependent, indecisive, high-strung, hostile, irritable, and lacking self-control. Normal college women with this pattern see themselves as cheerful, outgoing, and optimistic. Because they tend to have repressive tendencies, their self-perception is often incomplete and inaccurate. They are seen by others as flighty, immature, and sometimes naively hostile people who may develop physical symptoms under stress.

In counseling situations, Drake (1959) had described similar groups

of college women as outgoing people who were rea[illegible]ble to converse about their problems. They were often lacking [illegible]demic drive and found themselves blocking and tightening up on examinations. Their lack of academic drive seemed to be related to their rather strongly marriage-oriented view of college life. This orientation toward marriage has implications in the selection and training of women for the health related professions. Much time, money, and effort is spent on training women for these professions who are more family-centered than job-centered. Such women are likely to drop out of school to get married, or to complete college, marry and then leave their profession for good.

Rossi (1965) reported that a large proportion of women in the 24-44 year old group withdraw from work because of family responsibilities. The women's work pattern shows a peak of working activity in the early 20's and again in the 40's and early 50's. However, the 24-44 age period seems to be the most creative time for women, as it is for men. It is of interest here that Rossi suggests that mothers should not be tied down because evidence indicates that maternal employment has no unfavorable effect on the children. Furthermore, she states, the job may keep her alert, thereby benefiting the children's development.

It is planned in this present research program to determine whether those students who received high factor scores on Factor III will be more likely to marry and drop out of college than those students who score low on Factor III. Moreover, since college women with this profile pattern may be lacking in academic drive, it is planned to see if those who score high on Factor III do worse academically than those who score low. Factor IV will not be considered because of the relatively small variance for which it accounts, and the small magnitude of its loadings. It was interpreted as a residual factor. In summary, the correlations among the ten basic MMPI scales were accounted for by three significant factors. These factors were considered to reflect underlying characteristics as measured by the MMPI, in students interested in some of the health and rehabilitation professions.

## Factor Analysis of the Strong Vocational Interest Blank (SVIB)

Most of the factor analytic and other research with the SVIB has been done with the male form. There have been some factor analyses of items which make up the separate keys of the most recent female form of the SVIB, but there have been no factor analyses of all of the scale scores. Strong (1948) believed that male and female interests were very similar. Strong pointed out that at least seven factor analyses have

indicated that only four or five factors were needed to account for the variance among the scales. One reason in the present research program for factor analyzing the female form of the SVIB was to determine whether the underlying factor pattern and dimensionality of the female form was similar to that of the male form. However, the primary purpose of the present analysis was to determine the underlying structure of interests for female students interested in the health related professions.

The sample in the present study consisted of 203 freshman and sophomore women students who expressed an interest in the health related professions. The intercorrelations among 29 of the SVIB scales were computed and the intercorrelation matrix factor analyzed with squared multiple correlation coefficients in the principal diagonal by the principal components method (see Anderson, 1965). The 29 scales which were analyzed are listed in Table 3. The Engineer, Physical Therapist, and Sister Teacher Scales were not scored for this sample. Sixteen principal components effectively traced the correlation matrix. After these 16 factors were rotated, there were nine factors having two or more variables with loadings of (plus or minus) .35 or more. These factors were considered significant in the analysis and are presented in Table 3.

The first five factors are bipolar in nature. Factor I has skilled technical and clerical vocations loading on the positive end and professional vocations loading on the negative end. Factor II is characterized by the technical scientific professions in contrast to the non-scientific professions. Factor III is characterized by home and children-oriented interests versus career-oriented interests. Housewife and Elementary Teacher scales load on the negative end and Lawyer, Insurance Saleswoman, and Psychologist load on the positive end of this factor. Factor IV is of special interest in that scales measuring interest in the health related professions (i.e., Occupational Therapy and Nursing) load heavily on this factor. One should note that the Nursing scale and Occupational Therapy scale both load significantly on only one factor. This is in contrast to many of the scales which load on two or more factors. (For example, the Librarian scale has significant loadings on four separate factors.) This finding suggests that interest in the health related professions may be more homogeneous in nature than interest in some of the other occupational areas.

It should be noted that the Laboratory Technology (LT) scale loads highly on Factor II, rather than Factor IV, suggesting the statistical independence of LT from the other health related professions. This scale was validated on a group of medical technologists, and can be considered as a measure of interest in that field. Moreover, LT seems to be associated with masculine interests as indicated by the substantial

TABLE 3

Major Factor Loadings* From the Female Form of the SVIB (N=203)

| Occupational Scales | I | II | III | IV | V | VI | VII | VIII | IX |
|---|---|---|---|---|---|---|---|---|---|
| 1. Occupational Therapist | | | | 76 | | | | | |
| 2. Laboratory Technician | | —89 | | | | | | | |
| 3. Housewife | 66 | | —47 | | | | | | |
| 4. Stenographer-Secretary | 80 | | | | | | | | |
| 5. Physician | —56 | —66 | | | | | | | |
| 6. Social Worker | | 38 | | | | 55 | | | |
| 7. Artist | —75 | | | | | | | | |
| 8. Author | —74 | | | | | | | | |
| 9. Business Education Teacher | 88 | | | | | | | | |
| 10. Buyer | 51 | 50 | | | | | | | |
| 11. Dentist | | —87 | | | | | | | |
| 12. Dietician | 45 | | | | | | | 66 | |
| 13. Elementary Teacher | 51 | | —37 | | | | 39 | | |
| 14. English Teacher | | 38 | | | | | 71 | | |
| 15. Home Economics Teacher | 41 | | | 39 | | | | 65 | |
| 16. Life Insurance Saleswoman | | 56 | 45 | | | | | | |
| 17. Lawyer | | | 80 | | | | | | |
| 18. Librarian | —49 | —38 | | —37 | —41 | | | | |
| 19. Mathematics and Science Teacher | | —80 | | | | | | | |
| 20. Music Performer | | 54 | | | | | | | 55 |
| 21. Music Teacher | | 60 | | | | | | | 49 |
| 22. Nurse | | | | 69 | | | | | |
| 23. Office Worker | 85 | | | | | | | | |
| 24. Physical Education Teacher (College) | | | | | 40 | 65 | | | |
| 25. Physical Education Teacher | | | | | 75 | | | | |
| 26. Psychologist | —38 | | 67 | | | | | | |
| 27. Social Science Teacher | | | | | | 39 | 65 | | |
| 28. Y.W.C.A. Secretary | | | | | | 79 | | | |
| 29. Masculinity-Femininity | | 62 | | 40 | | | | | |

* Blank cells indicate loadings between —.35 and +.35. Decimals are omitted.

M-F loading on Factor II; while the health related professions may tend to involve feminine interests, as is suggested by the moderate loading of M-F on Factor IV. Subsequently more evidence will be examined concerning the differences between the MT group and the other health related professions in this present sample.

Factor V is determined by physical education teaching occupational interests. Factor VI is determined mostly by social service vocational interests, although the College Physical Education Teacher Scale has a high loading on this factor also. It should be noted that the social service

TABLE 4

Occupational Classification Based on the Results of the Present Factor Analytic Study and Strong's Grouping of SVIB Scales

| Factor Analytic Group | Occupational Scales | Strong's Group | Occupational Scales |
|---|---|---|---|
| I | Housewife, Elementary Teacher, Science Teacher, Social Worker, Y.W.C.A. Secretary | A | Artist, Author, Librarian |
| II | Physician, Laboratory Technician, Dentist, Mathematics and Science Teacher | B | English Teacher |
| III | Artist, Author, Libarian | C | Social Worker, Psychologist |
| IV | Stenographer-Secretary, Business Education Teacher, Buyer, Office Worker | D | Social Science Teacher, Y.W.C.A. Secretary |
| V | Dietician, Home Economics Teacher | E | Lawyer, Life Insurance Saleswoman |
| VI | Occupational Therapist, Nurse | F | Buyer |
| VII | Lawyer, Life Insurance Saleswoman, Psychologist | G | Business Education Teacher, Office Worker, Stenographer |
| VIII | Music Performer, Music Teacher | H | Housewife, Elementary Teacher |
| IX | Physical Education Teacher (College), Physical Education Teacher | I | Home Economics Teacher, Dietician |
| | | J | Physical Education Teacher (H.S.) |
| | | K | Occupational Therapist, Nurse |
| | | L | Mathematics-Science Teacher |
| | | M | Dentist, Laboratory Technician, Physician |
| | | N | Musician (Performer), Music Teacher |

vocations load on a factor independent of the factor determined by the health related professions. Although both groups of professions provide a public service which involves helping "unfortunate" people with problems, the two groups probably deal to some extent with different kinds of people and problems. Factor VII is defined by non-scientific teaching ocupations, Factor VIII by culinary occupations, and Factor IX by musical vocational interests.

An unexpected finding from this analysis was that, although there are fewer scales in the female form than in the male form of the SVIB, about twice as many factors were needed to account for the intercorrelations of the female scales. This suggests that female interests may be more complex than male interests. However, this finding could result from an artifact due to differences in the factoring and rotational techniques between the earlier studies and the present study. It is even possible that this finding could reflect particular characteristics of this sample.

The occupational groups based upon the present factor analysis tend to be in agreement with Strong's grouping on the back of the female form of the SVIB. However, the present factor analytic grouping is more condensed than Strong's. The two groupings are listed in Table 4. As can be seen from this table, five of Strong's SVIB groups are the same as the present groups. Also, the present groups II and IV both represent two or more of Strong's groups. Moreover, the present group I is a combination of four of Strong's groups except for the Psychologist scale. The present group VII is composed of the Lawyer and Life Insurance Saleswoman scales which Strong also lumps together.

In summary, it seems, at least for female students interested in the health professions, that their interests are more complex than male interests. Interest in the health professions seems to be relatively unidimensional in nature, possibly indicating a general interest in the rehabilitation specialities as a whole. However, as will be indicated below, the SVIB is an effective discriminator among the various groups in the present investigation.

## Differential Classification of Four Student Groups

The data from five psychological tests gathered by the Research Institute and described above have been analyzed by discriminant analysis to determine if OTs, PTs, MTs, and Os could be effectively discriminated from each other (Anderson and Barry, 1965). It should be pointed out again that these four groups were composed upon the basis of their responses to a questionnaire answered in their sophomore year regarding their *intended* major. In other words, the criterion in this

study was the stated intention of the student to major in a given professional field. The Attitude Towards Disabled Persons Test data were analyzed by analysis of variance. The rest of the test data was analyzed by computing generalized D squares, and in appropriate instances, likelihood functions. The D Square test is a multivariate statistical technique designed to ascertain whether discrimination among a number of groups on a number of intercorrelated test variables is possible. The significance of the D Square when referred to a Chi Square table with the appropriate degrees of freedom indicates whether the test vectors of the four groups differ significantly from each other.

If the D Square test indicates that the groups do differ significantly from each other, then likelihood functions can be developed that assign students to the various groups. In other words, the likelihood functions indicate the probability of a student belonging to a particular group on the basis of the expected frequency of occurrence of the student's score pattern for the various groups. These likelihood functions maximize classification efficiency. After a likelihood function is developed for each of the groups, and a student's test scores are substituted in each of the equations, he is subsequently predicted to be a member of that group which yields the largest likelihood function.

## Florida Placement Examination Analysis

One of the five sets of test data analyzed was the Florida Placement Examination (FPE). Utilizing a Chi Square Test, it was found that the four groups can be discriminated on the basis of the five subtests of the FPE. The likelihood function equations for maximizing classification efficiency are presented in Table 5. The efficiency of classification can be inferred to some extent from an a posteriori classification of the students on the basis of the likelihood functions. Table 6 contains a classification table based on these functions. The rows of the table represent actual group membership while the columns represent predicted group membership. For example, of the 43 members of the MT group, 24 were correctly classified as MTs, ten were incorrectly classified as OTs, five were incorrectly classified as PTs, and four were

TABLE 5

FPE Likelihood Functions for Maximizing Group Differences

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MT | = | 0.14 | Psy | + | 0.20 | Eng | + | 9.18 | N.S. | + | 2.50 | S.S. |
| OT | = | 0.17 | Psy | + | 0.17 | Eng | + | 9.19 | N.S. | + | 4.21 | S.S. |
| PT | = | 0.18 | Psy | + | 0.16 | Eng | + | 8.97 | N.S. | — | 2.76 | S.S. |
| O | = | 0.17 | Psy | + | 0.18 | Eng | + | 9.99 | N.S. | —27.50 | | S.S. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| + | 0.16 | Math | — | 25.31 | | | |
| + | 0.11 | Math | — | 22.95 | | | |
| + | 0.15 | Math | — | 20.99 | | | |
| + | 0.15 | Math | — | 23.04 | | | |

TABLE 6

Table of Predicted Group Membership Based Upon Likelihood Functions From Table 5

| Actual Group | Predicted Group | | | | | % Correctly Classified |
|---|---|---|---|---|---|---|
| | MT | OT | PT | O | Total | |
| MT | 24 | 10 | 5 | 4 | 43 | 56% |
| OT | 6 | 11 | 1 | 2 | 20 | 55% |
| PT | 7 | 5 | 13 | 3 | 28 | 46% |
| O | 22 | 18 | 18 | 8 | 66 | 12% |
| TOTAL | 59 | 44 | 37 | 17 | 157 | 36% |

incorrectly classified as Os.

The compounding coefficients or weights of the likelihood functions indicate the relative importance of the test variables in determining group membership. Cursory examination of the weights indicate that Natural Science (NS) and Social Science (SS) are by far the most important variables for determining group membership. The PTs scored lowest on both the NS and SS subtests of the FPE, indicating a relatively lower level of achievement in these areas for students interested in entering PT.

Table 6 indicates that membership in the OT, PT, and MT groups can be fairly well predicted on the basis of the likelihood functions. However, for the actual O group, more people are predicted to be members of each of the remaining three groups than of the O group itself. This could be due in part to the more heterogeneous nature of the O group. The O group was composed of students who were potential majors in many fields, while the remaining three groups were composed of students who intended to major in one particular field. It will be interesting to see if those O students who were predicted by the likelihood functions to enter an OT, PT, or MT program did in fact do so. A follow-up analysis designed to answer this question is planned.

The sample sizes and means of the five groups on the FPE subtests are listed in Table 7. It is interesting to note that the MT group scored higher than the remaining groups on the math subtest. The MT curriculum suggests that the student and job demands on medical technologists are more quantitative than such demands on the remaining groups of students. Physical therapy students seem to have a slightly lower overall profile than the other three groups.

In general, among students in these health related professions, students who expressed interest in MT had the highest level of overall achievement, those expressing interest in OT, the next highest, and those expressing interest in PT, the lowest level of overall academic achievement.

TABLE 7

Sample Sizes and Means for Florida Placement Examination Sub-tests

| Florida Placement Examination Sub-test | MT (N = 43) | OT (N = 20) | PT (N = 28) | O (N = 66) |
|---|---|---|---|---|
| Psy | 80.23 | 80.70 | 76.14 | 79.08 |
| Eng | 84.95 | 79.60 | 74.18 | 79.14 |
| N.S. | 79.21 | 79.05 | 72.50 | 77.80 |
| S.S. | 78.77 | 78.70 | 63.39 | 71.26 |
| Math | 81.26 | 70.60 | 74.11 | 76.17 |

## Minnesota Multiphasic Personality Inventory Analysis

The second analysis consisted of a discriminant analysis of three MMPI group (or estimated factor) scores derived from the ten clinical scales of the Minnesota Multiphasic Personality Inventory (MMPI). These three MMPI scores were obtained by the grouping suggested in the above-mentioned MMPI factor analysis discussion. The three groupings or factors of the MMPI scales are listed in Table 8. The sample sizes and means for each of the three MMPI factor scores are given for each of the professional specialities in Table 9. The discriminant analysis resulted in a Chi Square of 11.84 which, with 9 degrees of freedom, was not significant at the .05 level. This indicates that as far as these MMPI factors are concerned, there are no significant personality differences among the four groups of students. It is hoped that with a larger sample size, more precise factor score estimation techniques, and a more stringent criterion of group composition (i.e., actual enrollment), personality differences among these four groups will be reflected by the MMPI.

Although little research has been concerned with MMPI differences among the present groups, some use of the MMPI has been made in examining differences among other college curricula groups. Clark (1953) found that profiles for each of a large number of college majors (13 majors for males and 12 for females) showed few significant differences from the average college profile. It is of interest to note that the majority of these differences were on the M-F scale which is interpreted by many investigators as a "masculinity and femininity of interest" scale. He used a sample of 707 male and 763 female students whose major areas of study included art, biological science, economics, education, English, and foreign languages. However, it should be noted that, while the six groups did not differ from an average profile, they still could have differed from each other.

Lough (1947) found the MMPI to be of little or no value for differentiating women students in liberal arts, nursing, and teacher training

TABLE 8

Factors or Groupings of the MMPI Scales from Data in Table 2

| Factors | MMPI Scales |
|---|---|
| I | Depression, Social Introversion, Paranoia, Psychasthenia |
| II | Psychopathic Deviate, Masculinity-Femininity, Schizophrenia, Hypomania |
| III | Hypochondriasis, Hysteria |

curricula. Harder (1959) reported no useful MMPI differences between business, education, and engineering students. Sternburg (1953), using the Kuder Preference Schedule, the Allport-Vernon Study of Values, and the MMPI found that students in nine major fields of study differed significantly from each other on at least one factor. His sample consisted of 30 male students in each of the nine fields. He found broader differences to exist between areas of study than between sub-specialties within a given field (e.g., mechanical vs. electrical engineering). Norman and Redlo (1952) found that certain scales differentiated seven major occupational groupings of students from the remainder of the students in their study. However, their research design involved comparing each of the seven groups separately with the remainder of the groups combined. There are weaknesses in such a design which have been avoided in the present research.

The reader may conclude that the results of most of these studies have not been particularly encouraging. However, many of these studies did not use the most efficient statistical techniques to analyze the data. In some cases, only univariate analyses of individual scales were considered. In other instances, methods of profile analyses were utilized which did not take into account the intercorrelations among the MMPI scales (which in most instances are rather high). Helmstader (1957), in an empirical study of 14 methods of analyzing group differences, found that discriminant analysis was one of the most efficient methods, even when its assumptions were violated. This is the method of choice in the present research.

TABLE 9

Sample Sizes and Means for MMPI Factor Scores

| MMPI Factor Scores | Groups | | | |
|---|---|---|---|---|
| | MT (N = 45) | OT (N = 27) | PT (N = 31) | O (N = 65) |
| I | 106.93 | 101.44 | 101.00 | 107.95 |
| II | 209.87 | 195.44 | 202.10 | 214.83 |
| III | 217.16 | 205.04 | 201.00 | 216.80 |

## School and College Ability Test Analysis

The discriminant analysis involving the Verbal (V) and Quantitative (Q) scores of the School and College Ability Test (SCAT) indicated that the four curriculum groups were not significantly different from each other on these two aptitudes. The sample sizes and means for the four groups on the two subtests are presented in Table 10. The scores were standardized with a mean of 50 and a standard deviation of ten. It is interesting to note that all groups are uniformly above average on the V scale, but slightly below average on the Q scale. This finding is congruent with the earlier analysis of the FPE where the OTs scored the lowest and the MTs scored the highest on the Math subtest. It appears that PTs and especially MTs are more quantitatively oriented than OTs. Moreover, it seems that both PT and MT require more quantitative work in their respective curricula than OT.

TABLE 10

Sample Sizes and Means for SCAT Sub-tests

| SCAT Sub-tests | Groups MT (N = 30) | OT (N = 13) | PT (N = 26) | O (N = 54) |
|---|---|---|---|---|
| Verbal | 58.67 | 59.77 | 57.42 | 55.89 |
| Quantitative | 50.50 | 37.16 | 47.00 | 48.93 |

## Attitude Toward Disabled Persons Test Analysis

The fourth analysis was focused upon the curriculum groups' differences in their attitudes toward disabled persons (ATDP). It was expected that OTs and PTs would have a more favorable attitude toward disabled persons than MTs and the Os. However, a simple analysis of variance indicated that there were no significant differences among the four groups as far as their attitudes toward disabled persons were concerned.

The sample sizes and means are presented in Table 11 and the analysis of variance of these data, in Table 12. An unexpected finding was that the MTs, who presumably will have the least contact with handicapped people, scored somewhat higher on the ATDP than OTs and Pts whose occupational role demands frequent contact with the handicapped. However, it is possible that the scale is not actually measuring what it was designed to measure. Rather, it might be measur-

TABLE 11

Sample Sizes and Means for the ATDP Scale

| | Groups | | | |
|---|---|---|---|---|
| | PT (N = 31) | OT (N = 19) | MT (N = 41) | O (N = 71) |
| ATDP | 67.90 | 62.90 | 56.16 | 61.83 |

ing the degree to which people view the disabled person as different from the normal individual. If this notion is correct, then one might expect to find either no differences between students in and outside of the rehabilitation fields, or to find students in the rehabilitation fields scoring lower on the ATDP. This latter, if found, might suggest that these students perceive greater differences between handicapped and non-handicapped people. Such a notion does not preclude the possibility of rehabilitation specialists behaving in a way more accepting of the handicapped than others not directly associated with the handicapped.

Consistent with the results in the present study, Bell (1962) found that rehabilitation workers did not score significantly higher on the ATDP than hospital employees not directly associated with the handicapped. Bell suggested some interesting hypotheses concerning the attitudes of rehabilitation workers. One hypothesis is that the efficient and successful therapist must accept the view that the disabled are to some extent different from normal individuals. Bell felt that the successful therapist should believe that the disabled person is somewhat different from the normal individual, but neither too different nor too similar. In other words, Bell hypothesized a curvilinear relationship between successful therapy and recognition that a disabled person is different from a normal person.

Siller and Chipman (1964), consistent with Bell and the present study, found only negligible relationships between the experience of working with the disabled and attitudes toward them. Siller and Chipman also found that age and sex did not appear to be systematically related to attitudes toward disabled persons. Siller and Chipman factor-

TABLE 12

Analysis of Variance Data for Testing Group Differences on the ATDP Scale

| | Sum of Squares | Degrees of Freedom | Mean Square | F-Value |
|---|---|---|---|---|
| Between Groups | 2475.55 | 3 | 825.18 | 1.27 |
| Within Groups | 102880.00 | 158 | 651.14 | |
| Total | 105355.55 | 161 | | |

analyzed the 20-item form of the ATDP test using data from three samples (high school students, college students, and adults). They found no support for the assumption of unidimensionality in attitudes toward the disabled.

Although there were basic differences in the factor structure of the three samples, a sizable factor labeled Hypersensitive-Depressed was isolated in all three analyses. Individuals scoring high on this factor accepted statements describing the handicapped as grouchy, worrying, more easily upset than the nondisabled, inclined to self-pity, etc. This finding signifies one of the ways in which the disabled are perceived to differ from the normal population. That is, they are more hypersensitive and depressed. This is consistent with Bell's notion that the ATDP measures an attitude that the handicapped differ in certain ways from the general population, rather than measuring an attitude of acceptance of the handicapped.

Siller and Chipman believe that attitudes toward the disabled are multi-dimensional. They assume these attitudes are a function of the type and severity of the disability, of specific experience with the handicapped, and possibly of certain personality determinants of the person who has the attitude. Consequently, they believe that using single attitude scores as a dependent variable could obscure real differences, as may be the case in the present study. Their belief concerning the complexity and multi-dimensionality of attitudes toward the handicapped is consistent with studies by Whiteman and Lukoff (1962) and Cohen and Struening (1962). More recently, Barker (1964) found evidence for two unique attitudinal factors toward disability. One attitudinal factor involved organic disorders and the other factor, functional disorders.

Siller is presently working on the development of scales designed to cope with some of the problems mentioned above. It is anticipated that if scales are developed which measure attitude components salient to relations with the disabled, differences among the health related professions and between the health related professions and other professions can be isolated.

## Strong Vocational Interest Blank Analysis

The fifth analysis involved a discriminant analysis of curriculum group differences using the factor score distributions of ten factors based upon the previously discussed SVIB factor analysis. Scores for factors I through IX were estimated by the summing of scales under each of the factor groupings as presented in the left-hand column of Table 4. Factor X was simply the score on the Masculinity-Femininity

TABLE 13

Sample Sizes and Means for SVIB Factor Scores

| Factor Scores | Groups | | | |
|---|---|---|---|---|
| | MT (N = 58) | OT (N = 43) | PT (N = 41) | O (N = 64) |
| I | 126.04 | 155.74 | 158.27 | 156.14 |
| II | 156.95 | 106.33 | 117.78 | 113.42 |
| III | 83.54 | 83.63 | 79.76 | 77.77 |
| IV | 115.38 | 110.49 | 118.51 | 128.59 |
| V | 59.98 | 71.47 | 65.85 | 57.47 |
| VI | 57.85 | 54.58 | 54.88 | 55.47 |
| VII | 55.07 | 60.86 | 60.22 | 61.30 |
| VIII | 42.41 | 65.37 | 60.20 | 55.31 |
| IX | 53.72 | 57.02 | 59.20 | 51.58 |
| X | 39.00 | 54.14 | 49.81 | 47.94 |

scale. The sample sizes and means for each of the four groups of students for the ten estimated factor scores are presented in Table 13. The discriminant analysis resulted in a Chi Square of 148.65 which, with 27 degrees of freedom, is significant beyond the .01 level. Therefore we can conclude that the four groups can be differentiated from each other on the basis of the ten factors.

Since the curriculum groups can be discriminated by the factors, likelihood function equations were computed for optimizing the efficiency of classification. These equations are presented in Table 14. The coefficients for Factors III, IV, VII, and IX have the highest positive weights, while the coefficients for Factor I have a high negative weight. These five factors, then, are the most important variables in discriminating among the four groups.

TABLE 14

SVIB Likelihood Functions for Maximizing Group Differences

| | |
|---|---|
| MT | — 4.70 I + 0.66 II + 1.80 III + 1.34 IV + 0.31 V<br>+ 0.48 VI + 1.03 VII + 0.68 VIII + 1.17 IX + 0.94 X — 317.59 |
| OT | — 4.90 I + 0.61 II + 1.83 III + 1.34 IV + 0.36 V<br>+ 0.48 VI + 1.04 VII + 0.68 VIII + 1.20 IX + 0.97 X — 319.76 |
| PT | — 3.66 I + 0.63 II + 1.83 III + 1.36 IV + 0.35 V<br>+ 0.46 VI + 1.04 VII + 0.68 VIII + 1.21 IX + 0.96 X — 323.99 |
| O | — 2.68 I + 0.63 II + 1.80 III + 1.35 IV + 0.32 V<br>+ 0.46 VI + 1.03 VII + 0.66 VIII + 1.15 IX + 0.95 X — 314.93 |

The MT group scored lower on Factors I and VII than the remaining three groups. High scores on these two factors primarily reflect interests in occupations requiring personal interaction with other people, most of the occupations being non-technical in nature. The PTs and Os score lowest on Factor III and the MTs and OTs, highest. Factor III is determined by interests that are associated with occupations requiring little interpersonal interaction. We might expect the MTs to score high on this factor, since they scored low on Factors I and VII, reflecting interests in occupations requiring more interpersonal interaction. OTs score lowest on Factor IV which reflects interests in business occupations. As might be expected, the PTs score highest on Factor IX which is primarily determined by physical education teacher interests.

This study also suggested that the MTs are most masculine and the OTs, most feminine in their interest patterns. This can be inferred from the means of Factor X for the four groups. Factor X is defined solely by the M-F scale. Although the weights in the likelihood equations for this factor are not among the highest, they are large enough to warrant its consideration as a determinant of curriculum choice. This conclusion is consistent with that from Clark's MMPI study (1953), mentioned above, in which most of the differences among a large number of college curriculum groups were accounted for by the MMPI M-F scale.

The classification matrix obtained from the likelihood function equations is presented in Table 15. It can be seen from this table that the greatest amount of misclassification (68 per cent) occurs for the PT groups, while the least amount of misclassification occurs for the MT (29 per cent).

TABLE 15

Predicted Group Membership Based Upon Likelihood Functions From Table 14

| Actual Group | Predicted Group | | | | | % Correctly Classified |
|---|---|---|---|---|---|---|
| | MT | OT | N | O | Total | |
| MT | 41 | 3 | 7 | 7 | 58 | 71% |
| OT | 5 | 22 | 10 | 6 | 43 | 51% |
| PT | 9 | 11 | 13 | 8 | 41 | 32% |
| O | 13 | 13 | 7 | 31 | 64 | 48% |
| Total | 68 | 49 | 37 | 52 | 206 | 52% |

Since both the FPE and SVIB could effectively discriminate among the groups and hence adequately classify individual students into the four groups, the efficiency of the two sets of likelihood functions were compared. There were 74 students common to the two analyses. Two classification matrices were computed, one based upon the SVIB equations and the other, based upon the FPE equations. It was found that

TABLE 16

Likelihood Functions for Predicting MT, OT, N, or O Group Membership From the SVIB OT, LT, and N Scales

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MT | .09 OT | + | .36 LT | + | .12 N | — | 11.33 |
| OT | .21 OT | + | .22 LT | + | .12 N | — | 10.14 |
| N | .08 OT | + | .21 LT | + | .25 N | — | 9.47 |
| O | .11 OT | + | .21 LT | + | .16 N | — | 8.25 |

the SVIB was much more effective in classifying the 74 students. The SVIB equations misclassified only one student, while the FPE equations misclassified 38 out of the 74 students. The SVIB analysis is encouraging, in that significant differences in interests occur among students relatively early in their professional careers.

Another study in the present research program confirming the effectiveness of the SVIB in classifying students in the health related professions has been carried out by Dunteman (1966). Using groups of OTs, MTs, Nurses (N), and Os, he found that the three relevant keys alone (i.e., Occupational Therapy, Laboratory Technicians, and Nursing) could effectively differentiate the four groups from each other, on the basis of a discriminant analysis.

Dunteman found that the least amount of misclassification occurred for the MT group, while the greatest amount of misclassification occurred for the O group. The likelihood functions for this study are present in Table 16 while the classification matrix is presented in Table 17. Both this analysis and the previous one (Tables 14 and 15) suggest that the MT group is separated further from the remaining groups than the remaining groups are separated from each other. This is indicated by the greater percentage of correct classification for the MT group in both analyses, and further substantiated in the second analysis by the fact that the Mahalanobis D Square is substantially greater for the MT-OT,

TABLE 17

Predicted Group Membership Based Upon the Likelihood Functions From Table 16

| Actual Group | Predicted Group | | | | | % Correctly Classified |
|---|---|---|---|---|---|---|
| | MT | OT | PT | O | Total | |
| MT | 27 | 3 | 2 | 4 | 36 | 75% |
| OT | 9 | 25 | 10 | 3 | 47 | 53% |
| N | 5 | 8 | 29 | 5 | 47 | 62% |
| O | 14 | 17 | 12 | 17 | 60 | 28% |
| Total | 55 | 53 | 53 | 29 | 190 | 52% |

MT-N, and MT-O comparisons than for the remaining three two-group comparisons.[2]

Dunteman's analysis, then, indicated that using only the three most relevant or most appropriate scales of the SVIB could lead to fairly adequate differentiation and classification efficiency for MTs, OTs, and Ns. As might be expected, the Os were relatively close to the centroids of the remaining three groups and, hence, could not be adequately classified on the basis of the three interest scales.

## Prediction of Performance in Occupational Therapy

Performance in the actual therapy setting is an important aspect in the roles of both OTs and PTs, but it is very difficult to define and predict. Booth (1957) found only small correlations (−.20 to +.22) between ratings of performance of OT students in clinical settings and a number of personality and interest scales. Likewise, Englehart (1957) found only small correlations (−.10 to +.23) between such ratings and selected college grades for OT students. The prediction of clinical performance of PTs was no more successful than of OTs. Stockmeyer (1959) reported low correlations between college grades and clinical performance. James (1960) has reported low correlations between ratings of clinical performance and the scales of the Guilford-Zimmerman Temperament Battery. None of the correlations in the above four studies are high enough for practical use in the prediction of clinical performance.

The only completed study so far in the present research program at this Institute designed to predict performance ratings in a clinical setting has been reported by Anderson and Jantzen (1965). In their study an attempt was made to predict the clinical performance ratings of OT students. The sample consisted of 28 OT students who graduated from the University of Florida between the years 1961 and 1964.

A performance rating form had been developed by the American Occupational Therapy Association. It had two parts. Part I consisted of a number of specific traits which were scored from −5 to +5 for ratings from "Failing to Excellent" in accordance with the scoring instructions accompanying the scale. There were 11 specific traits to be

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[2]The Mahalanobis D Square is a statistic indicating the magnitude of distance between two group centroids based upon $p$ variables. It is related to classification efficiency in that the greater the D Square between any two groups, the greater the efficiency of classification. It is also a multivariate procedure which takes into account the inter-correlations among the variables and is, as would be expected, a direct function of the two-group linear discriminant function.

TABLE 18

Intercorrelations*, Means and Standard Deviations (SD) of Course Grades and Clinical Rating Scales (N = 28)

| | Variables | | | | | | | Scales | | Mean | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | AI | PS | Eng | Logic | Math | Hum | Bio | Psy | Part I | Part II | | |
| AI | | .43 | .34 | .38 | .22 | .69 | .60 | .54 | .10 | .22 | 2.29 | .62 |
| PS | | | .07 | .19 | .45 | .21 | .53 | .48 | .21 | .16 | 2.34 | .68 |
| Eng | | | | .32 | —.06 | .57 | .43 | .17 | —.22 | —.16 | 2.54 | .80 |
| Logic | | | | | .19 | .24 | .49 | .06 | .21 | .25 | 2.68 | .68 |
| Math | | | | | | .20 | .47 | .24 | .09 | .08 | 2.39 | .72 |
| Hum | | | | | | | .42 | .48 | —.08 | —.16 | 2.51 | .64 |
| Bio | | | | | | | | .60 | .02 | .01 | 2.27 | .83 |
| Psy | | | | | | | | | .11 | .12 | 2.47 | .94 |
| Part I | | | | | | | | | | .69 | 247.39 | 24.43 |
| Part II | | | | | | | | | | | 157.71 | 8.61 |

* A correlation of .37 is significant at the .05 level, and one of .48, at the .01 level of confidence.

rated each having from five to eight categories contributing to any one trait score. Part II of the rating instrument contained seven ratings of the student's overall ability to function in the clinic. The items were similar to those of Part I and were scored from 8 to 25. Most students were rated by one supervisor, but for those few students who worked in two clinics the average of both ratings was utilized.

The achievement measures used to predict the clinical ratings were the grades in eight freshman and sophomore courses. These courses were American Institutions (AI), Physical Sciences (PS), English (Eng), Logic, Mathematics (Math), Humanities (Hum), Biology (Bio), and Psychology (Psy). The letter grades were converted to numbers in the following way: A = 4, B = 3, C = 2, D = 1, and E = 0 for computational purposes. Other achievement measures included the five Florida Placement Examination scores. A description of this standard achievement test has been given above.

The means, standard deviations, and intercorrelations of the eight course grades and the two parts of the clinical rating scale are presented in Table 18. The average course grade obtained by the OT students lies approximately midway between a B and a C. The overall rating obtained by adding the means of Part I and Part II of the rating scale is 405 which, according to recommended score equivalents, is about a high B rating.

An inspection of the correlation coefficients in Table 18 indicates that there are no correlations significant at the .05 level between any of the course grades and either part of the clinical rating scale. This

TABLE 19

Intercorrelations*, Means and Standard Deviations (SD) of FPE Subtest Scores and Clinical Rating Scales (N = 18)

| | Variables | | | | | Scales | | Mean | SD |
|---|---|---|---|---|---|---|---|---|---|
| | CA | Eng | NS | SS | Math | Part I | Part II | | |
| CA | | .76 | .70 | .46 | .48 | —.35 | —.27 | 76.67 | 20.69 |
| Eng | | | .58 | .29 | .61 | —.20 | —.26 | 77.83 | 19.00 |
| NS | | | | .71 | .70 | —.42 | —.29 | 79.78 | 14.57 |
| SS | | | | | .35 | —.41 | —.37 | 69.89 | 19.58 |
| Math | | | | | | —.35 | —.20 | 67.50 | 20.44 |
| Part I | | | | | | | .77 | 245.78 | 26.15 |
| Part II | | | | | | | | 157.94 | 8.37 |

* A correlation of .47 is significant at the .05 level, and one of .59, at the .01 level of confidence.

implies that subsequent clinical performance cannot be predicted from achievement in these selected freshman and sophomore courses. These results also suggest that academic and clinical performance are independent dimensions. This interpretation is consistent with other investigations, such as the nursing study cited above (Taylor, 1964), where two independent factors were isolated, an academic performance factor and a clinical performance factor.

Likewise, the FPE subtests failed to predict clinical ratings. The intercorrelations, means, and standard deviations of the FPE subtests and the two parts of the clinical rating scale are shown in Table 19. The results of this study suggest that other types of measures are needed to predict clinical performance. It would seem plausible that clinical performance might be better predicted from non-academic characteristics, such as those measured by personality and interest inventories. Also, it might be more appropriate to determine the dimensions of clinical performance rather than to focus on a global performance rating like that used in the present study.

It is expected that a factor analysis of the clinical rating form might reveal a number of independent dimensions of clinical performance which, individually or when combined in a weighted composite, might be more predictable. There are two ways in which such factors can be weighted to yield a composite criterion score. One method is to subjectively weigh each of the dimensions in terms of the researcher's evaluation of its importance to performance in a clinical situation.

The other method is through canonical correlational analysis which involves obtaining that linear function of the predictor variables (e.g., interest and personality scales) and that linear function of the criterion dimensions (e.g., the clinical performance ratings) which when cor-

related with each other will yield the highest correlation possible. An additional output of such an analysis would be the optimal weighting of both the predictor and criterion variables necessary to maximize the relation (correlation) between the two sets of variables. The relative magnitude of these weights for each of the functions indicates the importance of the variables in producing a maximum correlation between the two linear functions (i.e., weights which will produce the highest possible correlation between separate composites of the predictor and criterion variables). This analysis is tentatively planned in the near future.

## DISCUSSION

Of all the personality, interest, attitude, aptitude, and achievement variables studied so far in the present research program, the interest measures have most effectively differentiated among the student groups. This conclusion is in line with those of Blum (1947) who reported that vocational and non-vocational interest tendencies discriminated among five groups of students in different fields better than personality variables.

Holland (1959) has classified the major occupational environments into six categories, two of which seem to be pertinent to the present research programs. These two categories are the Supportive and Intellective occupational environments. Holland classified OTs and PTs as members of the Supportive environment, and MTs as members of the Intellective environment. Some of the occupational groups included in the Intellective environment by Holland are biologists, mathematicians, physicists, and chemists. Social workers, teachers, and nurses are examples of occupational groups belonging to the Supportive environment. Holland assumed that different types of people enter these different environments.

Holland (1959) hypothesized six personal orientations to correspond to the six occupational environments. Each orientation is characterized by a somewhat unique pattern of interests, values, attitudes, and personality traits. These six orientations can be ranked according to their strength for every individual. The orientation listed at the head of the hierarchy is considered the most important determinant of subsequent vocational choice. For example, the Supportive orientation is typical of individuals who prefer teaching or therapeutic roles reflecting a desire for attention and socialization in a structured anxiety-free setting. Such individuals, according to Holland, are responsible, socially-oriented and feminine. They tend to value the humanistic and religious. They are threatened by intellectual problem solving, but possess verbal

and interpersonal skills. Individuals characterized by the Intellective orientation are task-oriented and have high needs to organize and understand the world. They hold somewhat unconventional values and attitudes, and avoid interpersonal situations.

The data of the present research tentatively support some of Holland's notions in that students in the Supportive orientations (i.e., OTs and PTs) had more feminine characteristics, were more interpersonal and service oriented, less intellectively oriented, and scored slightly lower on a standardized achievement test (i.e., FPE) than the MT students (those in the Intellective orientation).

The present research program has focused upon the differentiation of groups of students electing different specific fields of study: OT, PT, MT, etc. A larger problem concerns the career patterns of these groups of students. By career pattern is meant a person's sequence of jobs, occupations, and positions throughout his working life. Studies are underway as a part of the present research program to follow-up the sample of students described above, and to collect further data in order to isolate antecedent factors (e.g., personality, aptitude, interest and biographical data) relating to their subsequent job performance, job stability, job sequence, job duration, and other significant aspects of the career patterns.

Super et al. (1957) has stated that a person selects a vocation in which the job requirements are consistent with his self-concept. For example, a person who regards himself as highly verbal, intelligent, and extroverted might select law as his profession if he regards lawyers as possessing these attributes. Super feels that the individual tries to match up his self-concept with the requirements of various occupations and finally selects that occupation which is the most congruent with his conceptions of himself.

Most investigators of vocational choice recognize the importance of socio-economic and personal history variables as well as personality, aptitude, and interest variables. In order to obtain information concerning some of these socio-economic and personal history variables, a Career Choice Questionnaire, briefly mentioned above in the design section of this monograph, was developed by the Regional Rehabilitation Research Institute. This questionnaire was composed of 35 multiple choice items which pertained to a number of factors expected to be related to vocational choice. The items sampled such information as socio-economic level, family characteristics, high school, academic and extra-curricular interests, and patterns and characteristics of career choice. This information is expected to supplement the test data mentioned above, and enhance both discrimination among the curriculum groups and prediction of success within the groups.

That the Career Choice Questionnaire might be useful in academic prediction has been demonstrated by Barger and Hall (1963), who examined the relationship of socio-economic and family variables to academic achievement for a large sample of University of Florida students. They found that female students whose fathers had some graduate or professional training, had significantly higher grades than those female students whose fathers did not have such training. Also of interest was their finding that the oldest child was more likely to develop a set of attitudes, values, and skills resulting in good academic performance and adjustment than were children in the other ordinal positions.

Consistent with this is Super's notion (1961) that occupational shifting and floundering after high school and college is negatively related to vocational maturity, personal adjustment, and socio-economic status as well as academic achievement. Roe (1957) also has reported that personality and family background are crucial determinants of vocational behavior. Slocum (1965) mentioned that the occupational choice of adolescents may be influenced by social and cultural factors, such as societal values and norms or reference group values. All of these considerations have to be included in any comprehensive theory of vocational choice.

In the present research, it is assumed that careers in PT, OT, and MT call for different personality and other requirements. It is also assumed that students who consider majoring in one of these fields have some knowledge of these requirements. Furthermore, it is assumed that the prospective student has specific ideas as to whether his interests, aptitudes, and personality traits are congruent with these requirements. It is conceivable that we are measuring self concepts in the present investigation, rather than other variables which the various test batteries purport to measure.

Furthermore, we would expect still better discrimination as the students improve their knowledge of the job requirements in the different health related professions. At least some of the beginning students in these fields do not have an adequate knowledge of these job requirements. For example, a preliminary analysis of responses to the Career Choice Questionnaires of University of Florida OT students indicated that these students had not actually heard of that field (OT) until they were almost 17 years of age. Also, MTs and PTs had not heard about their fields of choice until they were almost 15 years old. It would seem that compared to many other occupational groups (e.g., doctors, lawyers, engineers), this age may be rather late to begin learning of the existence of an occupational field.

Other personal history data collected by Clark (1965) from 18 uni-

versities throughout the United States, indicated that the median age for first learning of OT was higher yet, with an average span of about two years between first hearing about the occupation and then deciding to major in it. Clark's data suggest that most high school students have very little contact with information about OT. The students have primarily heard about these health related professions through personal contacts and through reading about them, rather than through high school guidance program career days, according to the quesionnaire responses of University of Florida students.

Super (1960) has discussed vocational maturity in terms of the specificity of planning for the preferred occupation, the specificity of information which the individual has about the preferred occupation, and the extent of his planning for it. From this point of view, students in the present research samples could certainly be considered vocationally immature. Slocum (1962) has pointed out that the vocational choices of adolescents are rarely based upon a thorough consideration of aptitudes, personality, interests, etc., in relation to knowledge of job opportunities and prospects.

Data from the University of Florida students suggest that more occupational information concerning these professions must be disseminated to the high school students, so that they will have an opportunity to acquaint themselves with job requirements and also have time to examine their own personal characteristics in relation to these various requirements. At the same time, students through counseling should become aware of their capabilities and interests.

## FUTURE PLANS

The results of the student classification analysis are encouraging in that both the SVIB and FPE data were useful in differentiating among the four groups of students, when the students were grouped according to stated vocational preference. If these groups were composed of students currently enrolled in these educational programs (i.e., OT, PT, MT, etc.), one would expect even better discrimination because the groups would be more homogeneous. Moreover, if these groups were composed of students who successfully graduated from these programs still better discrimination would be expected than in the previous instances, again due to the increased homogeneity. Discrimination analyses focused upon these questions are planned for the future.

In the present research program, there is primary interest in the characteristics of students who are successful in each of the programs. It is more meaningful to differentiate among groups of successful students than among groups composed on the basis of stated preference or actual enrollment. However, in the present research, it was clear that these preference groups could be differentiated. In the majority of instances, those students who indicated a preference for a particular major subsequently enrolled in the preferred program.

Since the time that the preference data were collected, those students who stated their preferences have formally declared their majors and in a few instances, have graduated. It is planned to examine the correspondence between the preferred major and the actual major of these students. Also of interest is the correspondence between the actual major and the major predicted on the basis of both the SVIB and FPE. It is expected that those students who stated a preference for one program but subsequently enrolled in another will have predictor data more like the students in the program in which actual enrollment occurred. It is expected, then, that students who did change their major, changed in the direction predicted by the likelihood functions.

Discriminant analyses similar to those reported above are being

carried out. There are a number of differences in the future analyses, however, which are expected to further clarify the differences and similarities among these student groups. The most important difference is that the curriculum groups are to be composed of students who are currently in or have graduated from one of the educational programs (i.e., OT, PT, MT, etc.). One would expect these groups to be more homogeneous and typical of students in these professional fields than the groups composed on the basis of a stated intention to major in a field. A number of students who stated an intention of majoring in a specified area did in fact major in some other field of study.

Also in future studies, different control group data will be used. Instead of using a group of Others as the only control group, an attempt will be made to include two additional control groups in the analyses: Education majors (E), and a group of Nursing students (N) who have successfully completed their sophomore year program. In effect, then, there will be five-group discriminant analysis with groups of Ns and Es being added to the OTs, PTs and MTs. The addition of these groups will yield more information as to how the groups which have been studied intensively (i.e., PTs and OTs) differ from other groups who vary in their degree of similarity to the OTs and PTs. For example, OTs, PTs and Ns are expected to cluster closer to each other than any of them would cluster to MTs or Es. These further studies are expected to provide information as to how the health related professions differ from each other, and also how they differ from other groups varying in extrinsic similarity to them.

It is felt that the E and N groups will be more meaningful comparison groups than the O group since the former groups are more homogeneous. The O group is composed of a number of subgroups each of which may have a different profile. Consequently, when the mean for the total O group is obtained, the profile is not very meaningful in that the overall profile is actually an average of a number of different profile groups.

In relation to this, it might be interesting to look at the within-group differences as well as the between-groups differences for the main groups being studied (OT, PT, MT, etc). In other words, are there subgroups of people within each curriculum? If there are, how many are there and what are the characteristics of the people comprising these subgroups? It is expected that these subgroups will be composed of students who have similar interest, aptitude, and personality profiles. There are a number of ways to obtain subgroups of similar profiles. These various methods have been described by Haggard et al. (1959), Sawrey et al. (1960), Nunnally (1962), and Ward and Hook (1963).

The method proposed by Nunnally (1962) is fairly efficient and easy

to handle. It involves factor analyzing a matrix of test score cross-products among people. This method results in groups of people (i.e., people factors instead of test factors) whose profiles within groups are similar in respect to elevation, pattern (shape), and scatter. If subgroups can be isolated within each curriculum, then these subgroups can be followed through their graduation and into the field to see if their subsequent behaviors can in part be predicted by differing test profiles. For example, in OT three subgroups of people, each group yielding a different mean profile might be found. It could be that people characterized by one of these profiles would be drawn toward working with psychiatric patients, while those people with another profile might be more interested in working with physically handicapped patients. OTs with a third profile might end up in administrative or research work. These profile subgroupings might also be related to other aspects of career patterning such as job stability and other aspects mentioned above in the discussion on career patterns and occupational choice.

For purposes of predicting success in each group, multiple regression analyses are planned, involving the prediction of both academic and clinical performance criteria. It is anticipated that since these two criterion components are relatively independent, separate regression equations composed of different test variables will be needed to predict each one. Clinical performance ratings on approximately 50 OTs are now available. Many predictor test scores are also available for these same students. Besides having scores on the MMPI, SVIB, FPE, SCAT, and ATDP, scores are available on the Minnesota Paper Form Board, Bennett Hand Tool Dexterity Test, Crawford Small Parts Dexterity Test, the 16 Personality Factor Test, and the California Test of Mental Maturity. Information from the Career Choice Questionnaire also is available. An attempt will be made to predict the clinical ratings with these data. Similar studies are anticipated for PTs.

In prediciting academic criteria, two methodological approaches are planned in the immediate future: (1) the usual linear multiple regression model, and (2) the use of the moderator variable approach. A moderator variable has been defined by Saunders (1956) as a continuous variable which systematically influences the predictive effectiveness of another psychological measure. For example, Barger and Hall (1964) found that the validity of the SCAT in predicting academic grade-point average at the University of Florida was a function of that MMPI scale on which the student scored the highest. The correlation between the SCAT and grade-point average (GPA) for 1002 female students was.53, but ranged from .39 to .66 when computed for each of the ten subgroups determined on the basis of the highest scale score. The findings

were the same for a group of 1780 male students.

In a quite analogous way in the present research program, an attempt will be made to use the MMPI as a moderator variable in predicting academic success with aptitude variables. Instead of using single scales as moderator variables, an attempt will be made to group subjects according to the similarity of their profiles, and then compute correlations between the aptitude measures and the grade-point averages (GPA) for each of the subgroups defined in this way. Scores on the SVIB can also be used as moderator variables in predicting academic performance. It might be expected, for example, that the predictability of the GPA might vary as a function of interest pattern. Moreover, certain scales of the MMPI might well moderate other MMPI scales, enhancing the prediction of clinical performance by the MMPI over that obtained by linear regression methods.

In addition to utilizing academic and clinical performance as criteria for OTs and PTs while in college, plans are being made to follow up these students after graduation to obtain information such as the type of job, sequence of jobs, rate of advancement, job stability, and various other indices of job performance. An attempt will be made to predict the above-mentioned aspects of career patterns with the predictor variables discussed throughout this monograph.

All of the analyses discussed above will be cross-validated on independent samples at the University of Florida. After the regression and discriminant equations are developed at the University of Florida, their generality will be checked out at other universities throughout the country.

It is anticipated that these studies will yield information which will be useful in the counseling and selection of students in the health related professions. Eventually, there will be equations to predict academic success, job success, and similarity to various professional groups. A potential student's test scores could be substituted into the three sets of equations and he could be advised and accepted into a program on the basis of his predicted academic and job achievement and his predicted similarity to various professional groups. A joint index could then be developed using information derived from both the regression and discriminant analyses for advising students into and out of some of the health related professions.

## SUMMARY

The main purpose of this longitudinal research program is to determine distinctive motivational, personality, and other personal characteristics of different groups of students in some of the health professions. Also, the prediction of both academic and job success within these same health professions is to be explored. This monograph describes the initial phases of this on-going research program.

The subjects of the present studies were predominantly freshman and sophomore female students enrolled in an introductory course designed to give an orientation to the health professions. These students were asked to state on a questionnaire in what field they planned to major. The students were divided into four groups, on the basis of their intention to major in medical technology (MT), physical therapy (PT), occupational therapy (OT), or some other field (O). Personality, interest, attitude, aptitude, and biographical information data were obtained from these students. Then discriminant analyses were made to determine whether these four groups of students could be significantly differentiated from each other on the basis of the above data. A further question concerned whether the differences among the groups of students were of practical significance in the identification of a student's group membership.

The findings, to date, are that the Florida Placement Examination (FPE), an achievement test, and the Strong Vocational Interest Blank (SVIB) discriminated among the groups, while the Minnesota Multiphasic Personality Inventory, School and College Ability Test, and the Attitude Toward Disabled Persons test did not. Furthermore, these differences were significant in a practical sense as well as in a statistical sense. On the basis of both achievement test scores and interest scores, the students could be adequately classified into the four groups. It was found that the SVIB predicted group membership far more efficiently than the FPE.

Separate factor analyses of the Minnesota Multiphasic Personality Inventory and the Strong Vocational Interest Blank suggested the underlying personality and interest structure of students in the health related professions. Use of the resulting factors simplified the discriminant analyses by reducing the number of dimensions needed to account for group differences.

The most important factor from the analysis of the MMPI was characterized as social submissiveness and emotional warmth in a serious, prone-to-worry person. The second most important factor was characterized by extroversion, social assertiveness, independence of thought and action, and a tendency toward unsettled personal identification and philosophy. The remaining factor appeared to reflect an impunitive attitude in the way people view others, the world, and themselves.

Nine factors were extracted from the SVIB. The fourth factor was of special interest because scales measuring interest in the health related professions loaded heavily on it. Both the Nursing and Occupational Therapy scales which were the major determinants of Factor IV loaded only on that Factor. This was in contrast to many of the other scales which had significant loadings on more than one factor. This factor analysis suggested that interest in the health professions may be more homogeneous in nature than many other interest areas.

Five factors of the SVIB enabled discrimination among the four groups. The MT group scored the lowest on two factors which reflected interest in non-technical occupations requiring personal interactions. Both PTs and Os scored low on a third factor which was defined by the Artist, Author, and Librarian interest scales. OTs scored lowest on a factor defined by clerical and business interest scales, and the PTs scored highest on a factor defined by physical education teacher scales.

An OT prediction study indicated that clinical ratings of OT performance could not be predicted from academic course grades or the FPE achievement test. This study suggested that clinical performance and academic achievement are relatively independent. It appears quite likely that non-intellective predictors will be needed to predict the clinical performance criteria.

Plans for future analyses were discussed, including follow up studies of current students after graduation. The same predictor data, used in the discriminant analysis, will be used again to predict OT and PT job success. Eventually, attempts will be made to develop a joint index using information derived from both regression and discriminant analyses for advising students into and out of some of the health related professions.

# APPENDIX

## Discriminant Analysis

Through the use of discriminant analysis (Anderson, 1966; Rao, 1952; Kendall, 1957), the differences between two or more groups (e.g., college majors) can be ascertained on the basis of two or more measures (e.g., personality traits, etc.). Then equations can be developed to predict to which group the students should be assigned. Discriminant analysis enables one to determine to which group a student seems to belong on the basis of his similarity to those people or students already in the group. A student would be advised into that group where there were the most individuals with profiles similar to his.

For example, Dunn (1959) found that he could differentiate 14 fields of concentration from each other on the basis of a discriminant analysis involving a number of aptitude and achievement tests along with some personal history information. For 11 of the 14 fields, he was able to correctly place from 25 to 68 per cent of the cross-validation sample on the basis of the test information. Considering that only aptitude and achievement measures were used, these results were encouraging. The inclusion of personality and interest measures might have even increased the discrimination among the 14 groups.

In the same study, Dunn also found that discriminant analysis was superior to regression analysis in predicting the field a student would enter. Tiedeman and Bryan (1954), King (1958), Christensen (1953), and others have also demonstrated differences among curricula groups through the use of discriminant analysis. Anderson and Leton (1963) and Leton and Anderson (1964) have demonstrated the usefulness of discriminant analysis in differentiating academic grade levels. For other more recent applications of discriminant analysis to academic problems, see Calia (1960) and Cole, Wilson, and Tiedeman (1964).

Excellent literature reviews of discriminant analyses have been made by Tatsuoka and Tiedeman (1954) and Creager (1957).

Rulon (1951) has discussed in detail the differences between regres-

sion and discrimanant analysis. Regression analysis indicates the degree of success which an individual might experience in a given group, while discriminant analysis indicates the person's similarity to that group. Both of these techniques are useful in their own right. One can not be substituted for the other. It is not always feasible to guide a student into that major field where his predicted grade-point average is the highest. In many instances, the predicted grade point average will be highest for the "easier" major fields of study. In some instances, students should also be guided into major fields which are congruent with their aptitudes, interests, and personality even when their predicted grade-point average might be higher in other fields. The latter information can be determined by discriminant analysis. Since both techniques yield useful information, Tatsuoka (1957) has proposed the use of a joint index based upon both regression and discriminant analysis for use in guidance settings.

There are two major and related approaches to discriminant analysis. Let us consider variables and groups, $p$ and $q$ in number, respectively, for expository purposes. One approach is to compute linear functions of the $p$ variables such that the value of the obtained linear function has a maximum between-group sum-of-squares relative to the within-group of sum-of-squares. The first of such linear functions (discriminant functions) will account for the maximum between-group variance. Next, the second linear function independent of the first which will account for the next greatest amount of between-group variance relative to within-group variance is computed and so on, until all the between-group variance on the $p$ variables is accounted for by the linear functions. The number of linear functions needed to account for the total between-group variances is $q$-1 or $p$, whichever is smaller. Each of the linear functions can be tested for significance. Usually the first few functions account for most of the between-group variation and these alone can be used to describe the group differences. These discriminant functions can then be used for predicting the probable group membership of new subjects on the basis of the same measurements.

In order to clarify the above discussion, the basic concepts of discriminant analysis are illustrated in Figure 1 for the case of two groups and two variables. Let us assume that one axis represents an OT interest scale and the other axis represents a PT interest scale. Each of the person's paired scores are represented by a point on a plane defined by the two scales. Plotting the points in this manner results in two overlapping swarms of points, one swarm for the PT group and one swarm for the OT group.

The bivariate mean for each group, i.e. $\bar{X}_1$, $\bar{X}_2$ is called the group centroid. The density of the points tapers off from the centroid in all

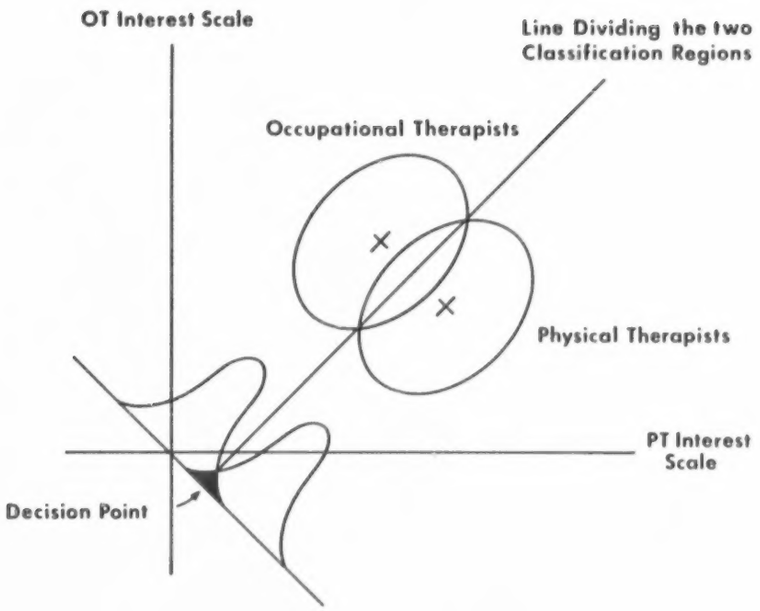


Fig. 1 Discriminant Function for Two Groups

directions. In Figure 1, the two swarms are each represented by their centroids and one of their density contours. The discriminant function is represented by the line through the origin of the coordinate axes at the bottom of the Figure. This line runs parallel to the line joining the group centroids. The projection of the points on this line results in two frequency distributions with maximum separation between the two means relative to the average within-group variation. The decision point is defined by the intersection of the two distributions and can be used to assign people to one or the other group with the maximum amount of correct classification. This is done by transforming future students' scores on the two interest scales to a discriminant function score and then classifying a student as an OT or PT depending on whether or not his discriminant score falls above or below the decision point. If there are more than two groups and all of the group centroids lie on a straight line in the test space, then a single discriminant function will exhaust all of the between-group variation. If the centroids for the $p$ tests lie in a two-dimensional plane, then two discriminant functions will be needed to exhaust all the between-group variation, etc.

The other approach to discriminant analysis can be accomplished directly by finding the probability of a bivariate score falling into each of the two groups and then assigning the individual to that group where the expected frequency of his score is greater. The basic solution, then,

is to compare the frequencies of the bivariate score (test profile) occurring in the OT and PT groups and then to assign the individual to that group which has the highest frequency of the bivariate score. This is done by computing likelihood functions for each individual and each group and assigning the individual to the group which yields the largest likelihood function. Likelihood functions indicate the probability of a person's score coming from that group. For example, a person with a bivariate score falling nearer the centroid of the OT group than to the centroid of the PT group would be assigned to the OT group since the frequency of this bivariate score is greater for the OT group than for the PT group.

This is the method of discriminant analysis proposed by Rao (1952), which involves dividing up the test space, which in the present example is a two-dimensional plane, into as many regions as there are groups (two in the present diagram). The regions are divided in our present example by the line which is perpendicular to the discriminant function line at the origin shown in Figure 1. Any bivariate score, falling to the left of this line is considered as belonging to the OT group, and conversely any bivariate score falling to the right of this dividing line, belongs to the PT group. Using this method, the scores are not first transformed to a discriminant score but are treated as they are, i.e., a point in the test space.

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